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BEAVER-WATERFOWL RELATIONSHIPS IN THE JEFFERSON BASIN

by

Lloyd G. Casagranda

Wildlife Restoration Division
August 5, 1955
Pittman-Robertson Federal Aid Project

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A STUDY OF BEAVER-WATERFOWL RELATIONS IN THE MOUNTAINOUS AREA OF BEAVERHEAD COUNTY, MONTANA

by

LLOYD G. CASAGRANDA

A THESIS

Submitted to the Graduate Faculty

in

partial fulfillment of the requirements

for the degree of

Master of Science in Fish and Wildlife Management

at

Montana State College

Approved:

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Head, Major Department

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Chairman, Examining Committee

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ABSTRACT

A study of beaver-waterfowl relations in a mountainous habitat was conducted July 1 to September 25, 1953 and March 24 to October 5, 1954 on three streams in Beaverhead County, Montana. Eight segments of the flood plains of one-half mile or more in length were selected as study areas. Data were obtained by observations on waterfowl and live-trapping, steel-trapping, and observations of beaver (Castor canadensis). Waterfowl usage of the study areas was correlated with the presence of beavers and beaver ponds. Beaver ponds used by waterfowl were evaluated against the remainder of the ponds as concerns surface area, relative depth, and presence of emergent aquatics. The importance of the ponds to waterfowl is discussed in relation to the remainder of the stream.

INTRODUCTION

An extensive study of beaver-waterfowl relations on a marsh-type habitat by Beard (1953) resulted in the conclusion that certain beaver activities materially benefit waterfowl. Numerous others have made observations of a similar nature but the literature apparently contains little quantitative information on this relationship in mountainous habitat. The present paper is the result of a study conducted July 1 to September 25, 1953 and March 24 to October 5, 1954 in the mountainous area of Beaverhead County, Montana. The results are analyzed to determine the extent to which ducks utilized mountain streams in common with beavers (Castor canadensis) and whether this usage was influenced by beaver activities.

Thanks are extended to the following for aid in the study: the Montana Fish and Game Department for financial support, equipment, and generous time of field personnel; J. E. Townsend, Montana Fish and Game Department, for valuable advice and field assistance; E. B. Harkness and W. L. Peterson for use of their lands as study areas; the U. S. Forest Service for providing bunkhouse facilities; H. Wombacher, C. Guse, and N. Welbourn for steel trapping beavers; K. Grieser for aid in the field; Dr. J. C. Wright, Montana State College, for verification of plant identifications. The writer further extends grateful appreciation to Dr. Don C. Quimby, Montana State College, who directed the study and supervised manuscript preparation.

THE STREAMS STUDIED

Three streams were selected for study; Sheep Creek, Bloody Dick Creek, and Darkhorse Creek.

Sheep Creek originated from tributaries which drained a basin of about 150 square miles. It flowed through narrow canyons, interrupted by hay meadows and valley floor, for 16 miles before entering the Red Rock River at Dell, Montana (Fig. 1). The gradient from the origin (elevation* 6,940) to the mouth (elevation, 6,155) was 51 feet per mile. Volume flow taken on Study Area II in May, 1954 (floating chip and watch method) was 56 cubic feet per second.

The width of the flood plain ranged from a few feet to about 300 yards. Dominant vegetation on the flood plain varied from woody shrubs to meadow grasses. The woody shrubs in the order of abundance were; willow (Salix spp.), water birch (Betula occidentalis), red osier dogwood (Cornus stolonifera), rose (Rosa spp.), and currant (Ribes spp.). Representative grasses included: inland giant wild-rye (Elymus cinereus), timothy (Phleum pratense), slender wheatgrass (Agropyron trachycaulum), foxtail barley (Hordeum jubatum), redtop (Agrostis alba), bluestem (Agropyron smithii), and needle-and-thread (Stipa comata). Other plants commonly occurring in local situations were Canada thistle (Cirsium arvense), iris (Iris missouriensis), thermopsis (Thermopsis montana), and goldenrod (Solidago elongata).

The lower slopes of the Sheep Creek valley were characterized by big sage (Artemisia tridentata) and rabbit brush (Chrysothamnus nauseosus)

* Elevations were estimated from U. S. Forest Service maps.

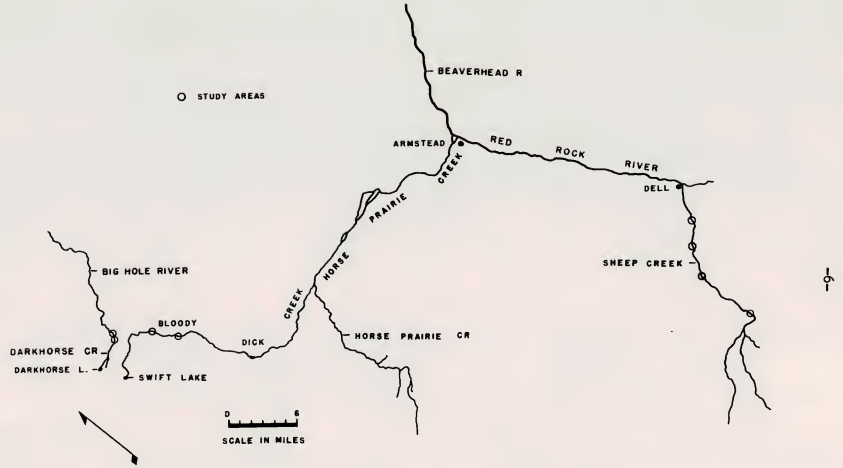

Fig. 1. Map showing positions of the study areas and relation of the streams studied.

locally interspersed with curleaf mountain mahogany (Cercocarpus ledifolius). The coniferous forest of the upper slopes was chiefly Douglas fir (Pseudotsuga taxifolia) with scattered limber pine (Pinus flexilis).

Bloody Dick Creek originated from Swift Lake (elevation, 8,010) and flowed through a narrow valley for approximately 19 miles before entering Horse Prairie Creek (elevation, 6,110). The latter stream joined the Red Rock River one mile north of Armstead to form the Beaverhead River (Fig. 1). Volume flow taken on Study Area V in May, 1954 (floating chip and watch method) was 21 cubic feet per sedond. The stream gradient was about 67 feet per mile.

Big sage was the dominant plant on the lower slopes of the Bloody Dick Creek Valley near its mouth. Midway up the valley it was replaced in dominance on the lower slopes by lodgepole pine (Pinus contorta). The vegetation on the upper slopes was principally lodgepole pine with scattered Douglas fir and alpine fir (Abies lasiocarpa). Engleman spruce (Picea englemanni) was found on some of the higher stream banks.

Most of the flood plain was less than 300 yards in width. The lower one-half only was used for hay meadows and pasture for cattle. The selection of study areas was confined to the upper segment where there was little disturbance and beaver ponds were numerous. Mountain meadows were typical of the wider portions of the flood plain in this region. Willow was the predominant woody shrub. Beaked sedge (Carex rostrata) and aquatic sedge (Carex aquatilis) were the dominant emergent aquatics. Some of the major grasses were northern reedgrass (Calamagrostis inexpansia),

alpine foxtail (Alopecurus alpinus), foxtail muhly (Muhlenbergia andina), beardless wheatgrass (Agropyron inerme), and redtop.

Darkhorse Creek originated from Darkhorse Lake (elevation, 7,950) and entered the Big Hole River about 4 miles downstream (elevation, 7,470). Its gradient was about 106 feet per mile. Volume flow taken on Study Area VIII in May, 1954 (floating chip and watch method) was about 18 cubic feet per second.

Vegetation on the flood plain and valley slopes was similar to that described for the upper segment of Bloody Dick Creek. The width of the flood plain varied from a few feet to about one-half mile but was mostly less than 150 yards.

METHODS

Preliminary surveys of portions of the flood plains in July, 1953 provided information on beaver abundance as determined by "sign". Segments of the flood plains were assigned to one of three categories; no beaver sign, moderate beaver sign, and abundant beaver sign. Eight segments of one-half mile or more in length, immediately adjacent to high peaks suitable for observation points, were selected as study areas. Two (one on Sheep Creek, the other on Darkhorse Creek) had no beaver sign. Four had moderate beaver sign (2 on Sheep Creek, one on Bloody Dick Creek, and one on Darkhorse Creek). One on Sheep Creek and one on Bloody Dick Creek had abundant sign.

Vegetative cover maps of the study sections were prepared on enlarged aerial photo tracings. They were cross-indexed for aid in recording the

location of field observations. Beaver ponds, lodges, and canals were plotted on the cover maps. The 18-inch contour line was established for beaver ponds. Parallel transect lines were established at intervals of 100 yards across each study area. The occurrence of vegetative types along the transect lines was recorded. Two 10 foot square plots randomly selected along each transect line were used as indicators of woody plant density. The number of woody stems per plot were counted. Stems intersected by diagonals drawn between opposite corners of the plots were measured for height and diameter 2 inches above the ground.

Duck activities on the study sections were observed from observation points with the aid of a 25 X spotting scope from April 1 until September 11, 1954. Observations were chiefly during 2, two-hour periods; one beginning at sunrise, the other 2 hours before sunset. One evening and one morning observation period was devoted to a study section before moving to another. This procedure was followed successively on all study sections.

The relative abundance of beavers on the study areas was determined by live-trapping and observations. Captured animals were ear tagged. They were aged (kits, yearlings, and two-year-olds or older) on the basis of the weight categories established for beavers in western Montana by Townsend (1953). Animals older than kits were sexed by the presence or absence of a baculum. Relative abundance was checked by steel trapping at the conclusion of the study, when an attempt was made to trap all beavers. Trapping was continued until no animals were caught for at least 3 days and no evidence of beaver activity was apparent. If no "sign" appeared

within the following week the areas were assumed to be trapped out. By these standards all Study Areas except VI and VII were successfully trapped.

THE STUDY AREAS

Study Area I was located in a livestock pasture on Sheep Creek, 3.5 miles above the mouth (elevation, 6,380). It was about 1170 yards long and averaged 230 yards wide (width of flood plain). The stream length within the Study Area was about 2190 yards. Its width averaged 24.5 feet.

Vegetation was of two types; willow (57%) and Canada thistle-iris (43%). The former occupied 72 per cent of the stream bank. It was located mainly within 50 yards of the stream where it flowed through the center of the Study Area and within 100 yards where the stream flowed along the edge of the flood plain. Canada thistle was the chief subdominant in this type. Rose (Rosa acicularis), water birch, iris, and thermopsis were found in lesser abundance. The average willow density was 1.1 stems per square foot. The stems averaged 46.5 inches in height and 0.44 inches in diameter. Thermopsis, foxtail barley, needle-and-thread, and big sage were some of the less abundant plants in the Canada thistle-iris type. The most abundant submerged plants on all Sheep Creek study areas were water crowfoot (Ranunculus aquatilis) and stiff water crowfoot (R. circinatus). Chara (Chara spp.) was also abundant.

"Old" beaver cuttings were observed on parts of the Study Area but no conspicuous structures (dams, lodges, ponds, or canals) were present. "Fresh" cuttings appeared in July, 1953 on the lower end of the section

only. Evidence of fresh cutting disappeared by August. No further "fresh sign" was observed until September, 1954, when fresh cuttings were again noted near the lower end.

Two beavers, a male and a female, were caught here in steel traps in November, 1954. Both were aged as two-year-olds. One had previously been live-trapped twice as a yearling on Study Area II (August 29 and September 20, 1953). The age of these beavers and the time of year suggest early colony formation (Townsend, 1953).

Study Area II was located within a pasture 2 miles upstream from Study Area I (elevation, 6,460). It was about 1205 yards long and averaged 154 yards wide. The stream within the study area was about 2,085 yards long and averaged 24.4 feet in width.

Vegetative cover was of 4 types; willow (47%), inland giant wildrye (39%), big sage-rabbit brush (12%), and Canada thistle-iris-thermopsis (2%). Over 80 per cent of the vegetation of the former type was composed of woody shrubs, three-fourths of which were willow. Water birch was next in abundance with lesser amounts of rose, currant, and dogwood. Goldenrod and Canada thistle were common. Density of woody shrubs was 1.1 stems per square foot. Stems averaged 89 inches in height and 0.91 inches in diameter. Most of this type was found within 50 yards of the stream. It occupied 73 per cent of the stream bank. Almost solid stands of inland giant wildrye were interspersed adjacent to the willow type. Big sage and rabbit brush were found on the edge of the flood plain.

Fresh beaver "sign" appeared throughout the area during the entire

study period. Seven beavers were live-trapped 9 times between August 29 and September 26, 1953. Included were 4 yearlings, a two-year-old, an adult male, and an adult female. Two of the yearlings were captured about one-half mile below Study Area I during the commercial trapping season in the spring of 1954. Another was recaptured as a two-year-old on Study Area I in the fall of 1954.

Five additional beavers and the adult male caught in 1953 were live-trapped on Study Area II in April and May, 1954. Three were yearlings and 2 were adult females. One of the adult females was found dead in June. The other was steel-trapped about three-tenths of a mile below the area in November, 1954.

Thirteen beavers (2 adult males, one adult female, 2 two-year-old males, 3 two-year-old females, 2 yearlings, and 3 kits) were steel-trapped on the area during October and November, 1954. Two of these, both two-year-olds, had been previously captured there in 1953. Two, a two-year-old male and a yearling, were previously caught there in 1954. One (adult male) had been captured on the area both summers. The colony status of this group of beavers was not readily interpreted.

Study Area III was located in a hay meadow 4 miles upstream from Study Area II (elevation, 6,600). It was about 1,055 yards long and averaged about 171 yards wide. The stream length within the Study Area was about 2,235 yards. Its width averaged 29.6 feet.

Common plants were slender wheatgrass, bluestem, timothy, northern reedgrass, clover (Trifolium repens), bearded wheatgrass (Agropyron sub-

Fig. 2. Observation point adjacent to Study Area II with a portion of the flood plain shown in the foreground.

Fig. 3. Aerial view of a portion of Study Area II and surrounding slopes. Observation point is above buildings.

secundum), meadow barley (Hordeum brachyantherum), and silverleaf cinquefoil (Potentilla anserina). A small sedge marsh containing two open water areas of about 50 square yards each, was located near the center of the section. No evidence of past or current beaver use was seen during the study.

Study Area IV was located within a hay meadow about 6.5 miles upstream from Study Area III (elevation, 6,900). It was about 1,055 yards long and averaged 288 yards in width. The stream length within the Study Area was about 1,500 yards. Its width averaged 8.6 feet. Two irrigation ditches, that extended the length of the Study Area parallel to the stream, flowed water at intervals during the spring and summer. Another ditch that paralleled the area took most of the water from the stream at a point above the Study Section.

Vegetation was of three types; meadow (62%), big sage (24%), and willow (14%). The former type occupied primarily the broad lower portion of the area. Representative plants included slender wheatgrass, bluestem, timothy, redtop, foxtail barley, and Baltic rush (Juncus balticus). Big sage, with lesser amounts of rabbit brush and inland giant wildrye, occupied the upper portion of the section. Willow, interspersed with meadow grasses, was found mostly within 30 yards of the stream and along the banks of irrigation ditches. The average willow density was 1.5 stems per square foot. Stems averaged 65 inches in height and 0.65 inches in diameter.

Aquatic vegetation was sparse.

Three beaver impoundments were present on the stream in September, 1953. Two, located near the upper end of the area, impounded little water and showed no sign of beaver occupancy in 1953 or 1954. Fresh dam repairs, willow cuttings, tracks, and observations of beavers indicated occupancy of the impoundment near the lower end of the area in 1953. This impoundment remained intact in 1954. The stream was dewatered for irrigation on May 1 but a small spring near the center of the area supplied enough water to keep the pond full. Beavers were seen there regularly during evening observation periods. The surface area of the pond was about 93 square yards. About 95 per cent was over 18 inches deep.

On July 17, 1954, a dam appeared in one of the irrigation ditches about 100 yards above the lower pond. A two-year-old male was live-trapped there 3 nights later. The following night a suckled female (conspicuous mammae) was live-trapped in the lower pond. Both beavers were transplanted away from the area and no fresh "sign" appeared following their removal.

Study Area V was located on Bloody Dick Creek, about 6 miles below its source (elevation, 7,260). It was about 900 yards long and averaged 210 yards in width. The stream length within the Study Area was about 1,772 yards. Its width (excluding beaver ponds) averaged 8.9 feet.

Vegetation was of a sedge-willow type. Willows, interspersed with sedges and grasses, were found throughout the Study Area but the heaviest concentrations occurred within 40 yards of the stream. The average willow density was 1.7 stems per square foot. Stems averaged 36 inches in height and 0.36 inches in diameter. Common sedges were beaked sedge and aquatic

sedge. Abundant grasses included bluejoint (Calamagrostis canadensis) and pinegrass (C. rubescens).

The most abundant submerged plants on the Bloody Dick Creek and Darkhorse Creek study areas were water crowfoot and stiff water crowfoot. Water starwort (Callitriche sp.), and mare's-tail (Hippuris vulgaris) were common in the beaver ponds. Green algae (Oedogonium sp.), (Spirogyra sp.), (Zygnema sp.), (Mougeotia sp.), and (Vaucheria sp.) were also common in the ponds.

Five beaver impoundments were present on the stream in 1954, all in the upper half of the Study Section. The average surface area was about 780 square yards (398 to 1239). About 65 per cent was over 18 inches deep.

Beavers were caught in each of the 5 ponds in 1954. An adult male was live-trapped 4 times (May 4, 6, 7, and September 1) in the 2 lower ponds. An adult female and a kit were live-trapped in one of these ponds on May 6 and September 1, respectively. All 3 of these beavers and an untagged kit were steel-trapped between October 30 and November 6. All were in one or the other of the 3 upper ponds. This evidence indicates a colony site.

Study Area VI was located 3.5 miles upstream from Study Area V (elevation, 7,420). It was about 1,000 yards long and averaged 266 yards in width. The stream length within the Study Area was 1,265 yards. Its width (excluding beaver ponds) averaged about 9 feet.

Vegetation was of two types; willow-sedge (91%) and lodgepole pine (9%). Willows and sedges, with lesser amounts of grasses and miscel-

laneous plants, were interspersed throughout the former type. The average willow density was 2.2 stems per square foot. Stems averaged 44 inches in height and 0.43 inches in diameter. Common sedges were beaked sedge and aquatic sedge. Abundant grasses included bluejoint and pinegrass. A stand of lodgepole pine extended on to the flood plain near the center of the area.

Eighteen major beaver impoundments (surface area greater than 150 square yards) were present on the section during the summer of 1953. Fourteen were located on the stream and 4 on beaver canals adjacent to the stream. Fifteen of these impoundments were intact in 1954. Three dams on the stream were broken and impounded little water. The average surface area of the major ponds was about 550 square yards (160 to 1,587). About 38 per cent was over 18 inches deep (14 to 77).

Seventeen minor beaver impoundments (surface area less than 50 square yards) were found on canals throughout the area in 1953. Twenty (including the 3 broken dams on the stream) were present in 1954.

Two, two-year-old female beavers were live-trapped in ponds on the upper third of the Study Section on September 10, 1953. One was recaptured in the same pond on the following night. In addition, an adult male and a yearling male were captured about 100 yards downstream in another pond. Both died in the traps. A dead kit was found in this pond on the following day. Ages of the latter beavers suggest a colony site. Fresh "sign" appeared in this vicinity at intervals throughout the summer of 1954 but disappeared by early fall.

Fig. 4. Sedge growths in one of the beaver ponds on Study Area VII. This type of pond was used most extensively by waterfowl.

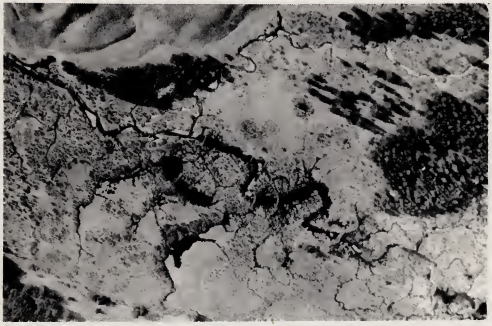

Fig. 5. Aerial photo of a portion of Study Area VI showing beaver dams, ponds, and canals.

A two-year-old male was live-trapped in a pond on a canal at the extreme lower end of the Study Area on September 18, 1953. He was recaptured in a crescent-shaped pond about 300 yards up this canal on May 29, 1954. Two beavers (one tagged) were seen there and in surrounding ponds during some observation periods through May, June, and July. An adult female was steel-trapped on October 28 in a pond on the stream joined to the crescent-shaped pond by a short canal. The male mentioned above was caught there on November 6. This suggests a colony site.

Little assurance could be placed on the complete removal of beavers by steel-trapping due to the irregularity of visits to the area during trapping operations.

Study Area VII was located on Darkhorse Creek, 3 miles below its source (elevation, 7,580). It was about 880 yards long and averaged 130 yards in width. The stream length within the Study Area was 1,100 yards. Its width (excluding beaver ponds) averaged about 11.2 feet.

Vegetation was of a sedge-willow-grass type. Sedges were most abundant on the lower half of the area; willows and grasses on the upper half. The average willow density was 2.1 stems per square foot. Stems averaged 24 inches in height and 0.31 inches in diameter. Common sedges were beaked sedge, Nebraska sedge (Carex nebraskensis), ovalhead sedge (Carex festivella), and aquatic sedge. Abundant grasses included bluejoint, pinegrass, shortawn foxtail (Alopecurus aequalis), and spike trisetum (Trisetum spicatum).

Five major beaver impoundments were present in 1954, all on the lower

one-third of the Study Section. All the ponds were connected, either by the stream or beaver canals. The average surface area of these ponds was 1,716 square yards (683 to 3,327). About 11 per cent (0 to 33) was over 18 inches deep.

Beavers were observed in the ponds at intervals between May and September, 1954. Two was the maximum number seen during any observation period. "Fresh" scats and cuttings were noted throughout the summer and a cache was begun in late August.

Study Area VIII was located within a mountain meadow immediately downstream from Study Area VII. It was about 900 yards long. The flood plain averaged about one-half mile in width but only the portion containing the meandering stream was included in the Study Section. The stream length within the area was about 1513 yards. Its width averaged 11.6 feet.

Vegetation was of a grass-sedge type. Dominant plants included June-grass (Koeleria cristata), bluegrasses (Poa spp.), spike trisetum, shortawn foxtail, pinegrass, beaked sedge, and spike-sedge (Eleocharis calva).

Three "old" broken beaver dams were present on the Study Section. None impounded water.

No indication of current beaver use was detected during the study.

WATERFOWL USE OF THE STUDY AREAS

For analysis, the 8 study areas were separated into 2 groups; one consisting of the 4 sections on Sheep Creek and the other, the 2 on Bloody Dick Creek and the 2 on Darkhorse Creek. Bloody Dick Creek and Darkhorse Creek were relatively comparable with respect to stream size, dam building

activities of beavers, and character of the flood plain and adjacent slopes. Both differed markedly from Sheep Creek in these respects.

Sheep Creek Study Areas

Study Area I. Thirteen mallards (Anas platyrhynchos) were seen on the Study Section during 4 observation periods between April 1 and April 8, 1954. Observations in this general locality indicated that the height of spring migration of mallards and pintails (Anas acuta) occurred during this time. Four territorial pairs (mallard) were recognized (April 7 - June 15). They were identified by the characters given by Hochbaum (1944) for distinguishing territorial pairs from transients. The total number of adult ducks (excluding females with broods) seen during 25 observation periods between April 11 and August 7, 1954 was 106 (96 mallards and 10 green-winged teals, Anas carolinensis).

A mallard hen and 3 downy young (Ia, Gollop and Marshall, 1954) were observed on June 15, 1954. A brood, presumably the same, was periodically observed to August 7. Apparently only one duckling survived to the fully-feathered class (III).

Study Area II. Thirteen mallards were seen during the height of spring migration (4 observation periods). Five territorial pairs (mallard) were recognized on the area (April 13 - June 7). Eighty-two adults (mallard) were seen during 15 observation periods between April 13 and June 7. Observations were continued until August 7 but no more ducks were observed.

Study Area III. A total of 187 spring migrants was seen during 4

observation periods. Included were 97 mallards, 79 pintails, 4 American goldeneyes (Bucephala clangula americana), 6 baldpates (Mareca americana), and one green-winged teal. Six territorial pairs (5 mallard and one green-winged teal) were recognized (April 13 - June 28). The total number of adult ducks seen during 20 observation periods between April 9 and June 28 was 153 (127 mallards and 26 green-winged teals).

A mallard hen and 12 downy young (Ia) were observed in the marsh on June 28. Subsequent observations were made on a brood in the marsh (assumed to be the same) until July 28. Apparently only 3 ducklings survived to the late partly-feathered plumage class (IIc).

A mallard hen and 11 downy young (Ia) were observed June 28 on the extreme lower end of the Study Area. No further observations of broods of a plumage class corresponding in development were made in this vicinity until August 3, when a female and 9 fully-feathered ducklings (III) were seen.

A mallard hen and 6 downy young (Ia) were observed on July 20. A brood of late downy young (assumed to be the same) were observed in the same general area on both July 28 and 29. Only 4 ducklings were seen with the female during the latter observation.

A green-winged teal hen and 10 fully-feathered ducklings (III) were seen August 3 on the lower end of the Study Area. A brood, presumably the same, was seen in the same vicinity the following day and again on August 7. Nine ducklings appeared with the female during the latter observation, 4 of them flying.

Study Area IV. Ice cover remained on the stream during the first 9 days of April prohibiting use by early spring migrants. One territorial pair (mallard) was recognized (April 25 - May 11). They (presumably the same pair) were seen on the stream below the lower beaver pond during 4 observation periods. There was no indication that the pond was included within the territory. The total number of adult ducks seen during 11 observation periods between April 14 and May 29 was 14 (10 mallards and 4 green-winged teals). Observations were continued until July 7 but no more ducks were seen.

Two of the Study Areas (I and III) apparently had no resident beaver colonies during the study period in 1954. No beavers or evidence of past or current beaver "sign" were seen on Study Area III. Study Area I was indicated to have had 2 beavers present in September as possible residents, but their late appearance could have had no influence on beaver-waterfowl relations in this study. Both Study Areas II and IV apparently had resident beaver colonies.

Study Area III, which lacked resident beaver, received the greatest use by waterfowl (Table I). Its waterfowl usage differed markedly from the other 3 study areas in all aspects except the number of territorial pairs. Five species of spring migrants were observed there as compared to one for Study Areas I and II and none for Study Area IV. More than 7 times as many migrants of all species were observed on Study Area III as on the remaining areas combined. All usage by migrants on Study Area III was observed on the stream. No ducks were seen on the marsh (see area

Table I. Waterfowl and beaver use of the Study Areas in 1954.

		WATERFOWL												BEAVER			
Study Areas	Streams	Spring Migrants		Territorial Pairs		Broods		Ducklings (maximum)		Ducklings (minimum)		Adults (Includes territorial pairs)		Minimum Number of Beaver	Minimum Number of Colonies	Number[2] of Beaver Ponds	Number of Ponds Used by Ducks
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%				
1	SC	13	6	4	25	1	20	3	7	1	4	106	30	2[1]	1[1]	0	0
2	SC	13	6	5	31	0	0	0	0	0	0	82	23	14	?	0	0
3	SC	187	88	6	38	4	80	39	93	25	96	153	43	0	0	0	0
4	SC	0	0	1	6	0	0	0	0	0	0	14	4	2	1	1	0
Totals		213	100	16	100	5	100	42	100	26	100	355	100	18	?	1	0
5	BD	0	0	0	0	0	0	0	0	0	0	7	14	4	1	5	2
6	BD	0	0	2	50	2	50	5	31	5	42	29	59	2	1	15	9(5)[3]
7	DH	0	0	1	25	2	50	11	69	7	58	8	16	2	1	5	5(5)
8	DH	0	0	1	25	0	0	0	0	0	0	5	10	0	0	0	0
Totals		0	0	4	100	4	100	16	100	12	100	49	99	8	3	25	16(10)

Symbols- SC, Sheep Creek; BD, Bloody Dick Creek; DH, Darkhorse Creek.
1-Present during latter part of study period only.
2-Does not include ponds under 50 square yards surface area.
3-Numbers in parenthesis designate the number of ponds used by "residents".

description) during this time. This Study Area was used by 80 per cent of the broods (4 of 5) and more than 90 per cent of the ducklings (maximum, 39 of 42; minimum, 25 of 26) observed on all 4 areas. The remaining ducklings were observed on the other Study Area (I) lacking resident beaver. Study Area III also received the greatest use by adults.

Little difference is discernible between the number of territorial pairs using Study Areas I, II, and III, especially when stream lengths and position of territories on the sections are considered. Study Area III harbored the greatest number of territorial pairs (6) and contained the most yards of stream (about 2,235). Observations indicated that 2 of these territories (one on each end) were probably only partially included in the Study Area, whose limits were designated only by visibility from the observation point. The same condition was indicated for one of the 5 territorial pairs on Study Area II.

Study Areas I and II were relatively comparable in total duck usage, although the former received slightly more use by adults and broods. Only Study Area II had a resident beaver population.

Study Area IV had a resident beaver colony and the only beaver pond on the Sheep Creek Study Areas. It received the least use by ducks. Only 4 per cent (14) of the total number of adults observed (355) used this area. One territorial pair was recognized. No ducks were observed on the beaver pond though it remained full throughout the summer. The low numbers of ducks using the area may be partially explained by the reduction of stream flow on May 1, although a territorial pair of mallards was ob-

served there on May 11.

These data do not indicate a positive correlation between the presence of beaver and watefowl usage on the Sheep Creek areas studied.

Bloody Dick Creek - Darkhorse Creek Study Areas

Study Area V. Ice cover remained on the stream until the last week in April, prohibiting use by early spring migrants. This condition was also true for the remaining 3 areas. No territorial pairs were recognized. The total number of adult ducks seen during 5 observation periods between May 4 and May 13 was 7 (6 green-winged teals and one mallard). Observations were continued until July 16 but no more ducks were seen.

Study Area VI. Two territorial pairs (one mallard and one green-winged teal) were recognized (May 22 - June 21). The total number of adult ducks seen during 14 observation periods between May 4 and June 21 was 29 (23 mallards and 6 green-winged teals).

A green-winged teal hen and at least one duckling (I) were observed on July 16 on a pond near the upper end of the section. A green-winged teal brood of 4 partly-feathered ducklings (IIb) were seen in the above pond on July 31. Subsequent observations on a brood (presumably the same) were made in an adjacent pond on July 31 and on August 11 (flying).

A mallard hen and one duckling (IIc) were observed on the crescent-shaped pond on August 19 and 20.

Study Area VII. One territorial pair (green-winged teal) was recognized (June 21). The total number of adult ducks seen during 12 observation periods between May 23 and July 30 was 8 (6 green-winged teals

and 2 mallards).

A mallard hen and 5 downy young (Ia) were seen on one of the beaver ponds on August 11. A mallard brood of a plumage class of corresponding development was seen on the same pond the following day and again on August 24 on an adjoining pond. Only 3 ducklings were seen with the female during the latter observation.

A green-winged teal hen and 6 downy young (Ia) were seen on the smallest pond on August 11. A brood of the same species of corresponding plumage class was seen on 3 other occasions (August 23, 24, and September 11) in surrounding ponds. Only 4 ducklings were seen with the female during the latter observations.

Study Area VIII. One territorial pair (mallard) was recognized (May 23 - May 25). The total number of adult ducks seen during 4 observation periods between May 23 and June 2 was 5 (3 mallards and 2 green-winged teals). Observations were continued until September 1 but no more ducks were seen.

Three of the Study Areas V, VI, and VII apparently had resident beaver colonies during the study period in 1954. No beaver or "fresh sign" was observed on the remaining Study Area (VIII).

Study Areas VI and VII received the greatest use by waterfowl. All of the broods (4) and ducklings (maximum, 16; minimum, 12) and three-fourths of both the territorial pairs (3 of 4) and adults (37 of 49) were observed on these areas. Study Area VI was superior to Study Area VII as concerns territorial pairs (2 to one) and adult usage (59 to 16). Little

difference is apparent as concerns brood usage. Study Area VI had 15 beaver ponds; Area VII had 5.

Only adult ducks were observed on Study Areas V and VIII. Seven (14%) were observed on Study Area V and 5 (10%) on Study Area VIII. One territorial pair was recognized on Study Area VIII.

The importance to waterfowl of pond building activities of beavers on these study areas is apparent when the waterfowl usage is examined in relation to the character of the total stream length of the 4 areas. About 51 per cent of the total stream length (2,909 of 5,650 yards) had no beaver ponds. All of the ponds were either on the other 2,741 yards of stream (49%) or connected to it by short canals. All of the duck use, with the exception of the five adults observed on Study Area VIII, was observed either on beaver ponds or on the stream or beaver canals between ponds. The latter 2 were used principally as avenues of travel between ponds.

Ducks were observed on 2 of the 5 ponds on Study Area V, 9 of the 15 on Study Area VI, and all 5 on Study Area VII. Ten of these ponds (5 on Study Area VI and 5 on Study Area VII) were used by "residents" (territorial pairs and/or broods). Use on the other 6 was by adults judged as "transients" and mostly limited to comparatively short periods. These ponds were considered of minor importance.

Collectively, the ponds used by "residents" on Study Area VI showed little difference in surface area or relative depth as compared to the remaining ponds. The average surface area of the 5 ponds used by "residents"

was 559 square yards compared to 546 square yards for the remaining 10 ponds. Thirty-six per cent of the former group of ponds was over 18 inches deep compared to 39 per cent for the latter group. The abundance of aquatic vegetation appeared to be about the same in both groups of ponds.

Individually, ponds receiving the greatest use had 2 features in common; comparatively greater size and shallower water containing growths of sedge. Both of the territorial pairs and one of the broods on Study Area VI used the largest pond on the section. Eighty-five per cent of this pond was less than 18 inches deep and about three-fourths of the shallow area contained sedges. The average surface area of the ponds receiving the greatest use on Study Area VII was even greater than the surface area of the largest pond on Study Area VI. Almost 90 per cent of these ponds was less than 18 inches deep and growths of sedge interspersed with open water were common in the shallow areas.

The evidence indicates that beaver, through their impoundments, created a habitat more suitable for waterfowl on the areas studied on Bloody Dick Creek and Darkhorse Creek.

SUMMARY

1. A study to determine beaver-waterfowl relations on 3 streams in the mountainous area of Beaverhead County, Montana was conducted July 1 to September 25, 1953 and March 24 to October 5, 1954.

2. Eight segments of the flood plains of one-half mile or more in length, immediately adjacent to high peaks suitable for observation

points, were selected as study areas. Four were on Sheep Creek, 2 on Bloody Dick Creek, and 2 on Darkhorse Creek.

3. Vegetative cover maps of the study areas were prepared and cross-indexed for aid in recording field observations. Beaver ponds, lodges, and canals were plotted on the cover maps. The 18-inch contour line was established for beaver ponds.

4. Parallel transect lines were established at intervals of 100 yards across each study area. The occurrence of vegetative types along the transect lines was recorded. Woody stem densities, heights, and diameters were measured on sample plots.

5. Duck activities on the study sections were observed from observation points from April 1 until September 11, 1954. Observations were chiefly during 2, two-hour periods; one beginning at sunrise, the other 2 hours before sunset.

6. The relative abundance of beavers on the study area was determined by live-trapping and observations. Beaver numbers were checked by steel trapping at the conclusion of the study.

7. For analysis, the 8 study areas were separated into 2 groups; one consisting of the 4 sections on Sheep Creek and the other, the 2 on Bloody Dick Creek and the 2 on Darkhorse Creek.

8. Two of the Sheep Creek Study Areas (I and III) apparently had no resident beaver colonies during the study period in 1954. Both Study Areas II and IV apparently had resident colonies.

9. Study Area III, which lacked resident beaver, received the great-

est use by waterfowl. Five species of spring migrants were observed there as compared to one for Study Areas I and II and none for Study Area IV. More than 7 times as many migrants of all species were observed on Study Area III than on the remaining areas combined. This Study Area was used by 80 per cent of the broods (4 of 5) and more than 90 per cent of the ducklings (maximum, 39 of 42; minimum, 25 of 26) observed on all 4 areas. It also received the greatest use by adults. Little difference was discernible between the number of territorial pairs using Study Areas I, II, and III.

10. Study Area IV had a resident beaver colony and the only beaver pond on the Sheep Creek areas. It received the least use by ducks. Only 4 per cent (14) of the total number of adult ducks observed (355) used this area.

11. These data do not indicate a positive correlation between the presence of beaver and waterfowl usage on the Sheep Creek areas.

12. Three of the Study Areas on Bloody Dick Creek and Darkhorse Creek (V, VI, and VII) apparently had resident beaver colonies during the study period in 1954. No beaver or "fresh sign" was observed on the remaining Study Area (VIII).

13. Study Areas VI and VII received the greatest use by waterfowl. All of the broods (4) and ducklings (maximum, 16; minimum, 12) and three-fourths of both the territorial pairs (3 of 4) and adults (37 of 49) were observed on these areas.

14. Study Area VI was superior to Study Area VII as concerns territorial pairs (2 to one) and adult usage (59 to 16). Little difference was

apparent as concerns brood usage. Study Area VI had 15 beaver ponds; Study Area VII had 5.

15. Only adult ducks were observed on Study Areas V and VIII. Seven (14%) were observed on Study Area V and 5 (10%) on Study Area VIII. One territorial pair was recognized on Study Area VIII.

16. About 51 per cent of the total stream length of Study Areas V, VI, VII, and VIII (2,909 of 5,650 yards) had no beaver ponds. All of the ponds were either on the other 2,741 yards of stream (49%) or connected to it by short canals. All of the duck use, with the exception of the 5 adults observed on Study Area VIII, was observed either on beaver ponds or on the stream or beaver canals between ponds.

17. Individually, ponds receiving the greatest use had 2 features in common; comparatively greater size and shallower water containing growths of sedge.

18. The evidence indicates that beaver, through their impoundments, created a habitat more suitable for waterfowl on the areas studied on Bloody Dick Creek and Darkhorse Creek.

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